Installation for monitoring gas cylinders

The invention relates to an installation for monitoring gas cylinders.

The use of industrial gases bottled in cylinders is very widespread throughout industry. The Applicant has noted that the management of an inventory of cylinders poses a number of problems, both for a supplier and for a consumer enterprise.

A consumer enterprise generally has a central depot to which the supplier delivers the gas cylinders as ordered. The cylinders are distributed from this central depot to the various departments of the enterprise so as to be conveyed by the staff to their point of use. These are referred to as "flying" cylinders so as to differentiate them from "manifold-connected" cylinders which are delivered and connected up by the supplier to their points of use.

As far as flying cylinders are concerned, the enterprise is often confronted with the following difficulties:

-Availability of full cylinders in the central depot-

Often, the number of full cylinders available in a central depot is not monitored. A user may then remove the last full cylinder of gas of a certain type without ordering a new one, through negligence or forgetfulness. The next user needing a gas cylinder of the same type is then held up in his work for as long as it takes to place an order and wait for the supplier to deliver the order.

-Overstocking-

In view of the problem set forth above, it may happen that several users independently of one another place orders for cylinders of the same type, either because they were unaware of the orders by the others, or out of fear of being held up in their work. Such behavior by the staff of the enterprise leads to overstocking which clutters the depot and reduces its storage capacity in respect of other types of gases. Moreover, such behavior gives rise to a considerable

increase in the cost of operating the inventory of cylinders, since the enterprise must pay a monthly rental fee for each cylinder, in addition to the gas contained in these cylinders.

-Excess number of empty cylinders and locating the latter on a site-

Often, used empty cylinders are not returned by the users to the central depot where the supplier collects them. Consequently, the number of flying cylinders in circulation within the enterprise increases considerably. In this case also, the enterprise must needlessly lay out a sizable sum for the rental of these unused empty cylinders.

Moreover, the unreturned cylinders are often set aside so that it is difficult, especially on a large-size industrial site, to retrieve them so as to put them back into circulation.

-Unauthorized use-

Access to the central cylinder storage depot is not always prohibited to unauthorized personnel, especially personnel who are foreign to the enterprise. Such personnel may then make fraudulent use of the gases purchased by the enterprise. Usually, these fraudulently handled cylinders are not even returned to the central depot. This fraudulent use gives rise to significant extra costs and impedes the management of an inventory of flying cylinders.

At least some of these drawbacks can be remedied by furnishing the enterprise with a central depot for gas cylinders managed by a stock controller. However, it is not always conceivable for a small or medium-sized enterprise to appoint such a stock controller since the inventory of flying cylinders is not very large. Additionally, in a large site of a major enterprise, the extent of the site often leads to the provision of several autonomously managed medium-sized depots at spots which are close to the points of use, instead of a large central depot with a stock controller.

Additionally, for enterprises having several industrial sites, the Applicant has noted that after their delivery the cylinders often circulate from one site to another, thereby posing the problem of ascertaining which site is to be invoiced for the contents and rental of these cylinders.

On the other hand, with regard to the matter of the filling of gas cylinders, the Applicant has observed that it is sometimes difficult to discern operating defects in a manifold for filling cylinders in batches.

Additionally, the Applicant has noted that the filling of a cylinder with a product, for example acetylene, intended to be dissolved in a solvent contained in the cylinder, has the drawback of requiring a considerable number of human interventions which significantly reduce the speed of a filling station for such products. Specifically, during the consumption of acetylene bottled in a gas cylinder and dissolved in a solvent, a fraction of the solvent is carried away so that once the acetylene in the cylinder has been exhausted, the remaining amount of solvent has decreased in an unknown manner. This is why, before being able to proceed with the filling with acetylene, the solvent must be topped up, thereby significantly increasing the duration of a filling cycle.

The invention aims to solve most of the diverse problems related to the management of containers in general, and of gas cylinders in particular, by proposing an installation for monitoring containers allowing better management of an inventory of containers both in respect of a consumer enterprise and a supplier.

For this purpose, the subject of the invention is an installation for monitoring containers each equipped with an information medium, comprising at least one storage zone for the containers including at least one access to the storage zone, provided with at least one reading device able to read the information

on the containers' information medium, and data exploitation means exploiting at least the information registered by the reading device.

The installation according to the invention can moreover comprise one or more of the following characteristics:

- the exploitation means comprise means for evaluating the stock of containers warehoused in the storage zone.

- the exploitation means comprise means for determining the positions of the containers in the storage zone.

- the storage zone comprises at least one facility for distributing a stock of containers comprising a storage space for the containers and means of authorization of removal of at least one container disposed in said storage space, said means of authorization comprising, on the one hand, disabling means, switchable between a position for disabling the containers disposed in the storage space and a distribution position in which at least one container is authorized to be removed, and, on the other hand, means of control of said disabling means.

- the information exploitation means furthermore comprise means for memorizing at least one minimum threshold of full containers, means for comparing the stock with the minimum threshold of full containers, means for triggering a replenishment order, controlled by the means for comparing the stock with the minimum threshold, and means for transmitting the replenishment order to a replenishment center.

Other characteristics and advantages of the invention will emerge from the following description, given by way of example, with no limiting character, of applications relating to gas cylinders, in conjunction with the appended drawings in which:

Figure 1 is a schematic diagram of an installation for monitoring gas cylinders in accordance with a first exemplary embodiment of the invention,

Figure 2 is a schematic diagram of the structure of an installation in accordance with a second exemplary embodiment,

Figure 3 is a schematic diagram of an electronic tag intended to be attached to a gas cylinder,

Figure 4 is a schematic diagram of the structure of an installation in accordance with a third exemplary embodiment,

Figure 5 is a diagram of an installation in accordance with a fourth exemplary embodiment,

Figure 6 is a schematic diagram of the structure of the installation of Figure 5,

Figure 7 is a diagram of a variant of the installation of Figure 5,

Figure 8 is a schematic diagram of the structure of the installation of Figure 7,

Figure 9 is a schematic diagram of an installation in accordance with a fifth exemplary embodiment,

Figure 10 is a schematic diagram of a variant of the installation represented in Figure 9,

Figure 11 is a schematic diagram of an installation in accordance with a sixth exemplary embodiment, and

Figure 12 is a schematic diagram of a variant of the installation represented in Figure 11.

The six exemplary embodiments of installations for monitoring gas cylinders will be described hereinbelow. For the sake of clarity, the identical elements of the various embodiments of the invention will bear the same reference numerals.

Exemplary embodiment No. 1:

Figure 1 shows a schematic diagram of a subassembly of an installation 1 for monitoring gas cylinders 3. The subassembly comprises a drivable functional unit 5 adapted for executing a predetermined task relating to said cylinders 3, namely the monitoring of limit dates such as for example the date

of expiry of a product contained in the cylinder 3 or the date of the next hydraulic test of the cylinder, as well as the triggering of an alarm in the event of one of these dates being overstepped.

For this purpose, the cylinder 3 comprises an information medium 7 made in the form of a bar-code tag 9 applied to the body 11 of the cylinder 3.

The bar-code tag 9 comprises various items of information about the cylinder 3, coded according to a coding process known per se. This information comprises not only the aforesaid limit dates, that is to say the dates of expiry and of the next hydraulic test, but also for example a number or code for identifying the cylinder, the type or types of gas contained in the cylinder, the nominal quantity of product contained in the cylinder, the tare of the cylinder, the number of the filling batch and a customer code.

To access the information recorded on the tag 9, the installation 1 comprises a reading device 13. This device 13 comprises a bar-code reader 15 and a unit 16 for interpreting the signals output by the reader 15.

The functional unit 5 comprises, linked to the reading device 13, means 17 for exploiting the information registered by the device 13 during a read. These means 17 comprise a clock 19 outputting the current date and time, means 21 for comparing dates, of which one input is linked to the clock 19 and of which another is linked to an output of the reading device 13. The output of the comparison means 21 is connected to alarm means 23. These alarm means comprise for example a display screen 25 and means 27 for emitting an audible signal.

During operation, the limit dates held in memory on the tag 9 are input with the reader 15. The device 13 then transmits these limit dates to the exploitation means 17 and more particularly to the comparison means 21. These means 21 compare the limit dates with that output by the clock 19. In the event of

one of the limit dates being overstepped, the comparison means 21 activate the alarm means 23 which display an alarm message on the screen 25 and trigger an audible signal emitted by the means 27.

The functional unit 5 and the reading device 13 are preferably installed either beside a point for connection of gas cylinders of the installation so as to prevent the use of a product which has expired, or on a facility for receiving or filling empty cylinders of the supplier responsible for maintaining his inventory of gas cylinders so as to subject them to regular hydraulic tests.

Exemplary embodiment No. 2:

Figures 2 and 3 show another embodiment of the installation 1. According to this embodiment, the task relating to gas cylinders 3 which is to be executed by the functional unit 5 pertains to the monitoring of a zone, such as for example a safety zone in a nuclear power plant, so as to prevent the introduction into this zone of gas cylinders 3 containing dangerous products such as inflammable products.

For this purpose, the information memorized on the information medium 7 comprises in particular the type or types of product contained in the cylinder 3. Advantageously, the information medium 7 is made in the form of an electronic tag 29 and the reading device 13 comprises instead of the bar-code reader 15 of Figure 1, means 31 of communication over the airwaves adapted so as to receive the information emitted by the electronic tag 29.

Electronic tags are known per se and sold for example by the company GEMPLUS (Gemenos, France). The electrical autonomy of such an electronic tag derives from a battery or, as is also known, the electronic tag can tap the energy required for its operation from the radio waves emitted by the communication means 31 of the device 13.

Figure 3 shows a schematic diagram of an electronic tag 29. It comprises means of emission

33 and means of reception 35 of information to or from the device 13, an information processing unit 37 linked to the means 33 and 35, as well as means 39 for memorizing the information relating to the cylinder 3 which are connected to the unit 37.

As may be seen in Figure 2, the exploitation means 17 of the functional unit 5 comprise means 41 for memorizing a list of product types allowed in the zone to be monitored, and comparison means 43, of which one input is linked to the means 41 for memorizing the list and of which another input is linked to an output of the reading device 13. The output of the comparison means 43 is linked to alarm means 45 comprising for example a siren 47 and a rotating light 49. The installation is for example mounted just in front of a door for access to the safety zone.

During the operation of this installation 1, the reading device 13 continuously emits radio waves in a region situated in front of the access to the safety zone so as to detect the passage of a gas cylinder moved by a user. In the case where a cylinder 3 is located in the region swept by the radio waves, the tag 29 emits the product type or types recorded in its memory means 39. This information is received by the reading device 13 and transmitted to the comparison means 43. If the product type or types read from the tag 29 are not among the list recorded in the means 41, the comparison means 43 activate the alarm means 45, that is to say they switch on the siren 47 and the rotating light 49.

In one development (not represented) of this exemplary embodiment, provision is made also to link the comparison means 43 to means for disabling the access door to the safety zone. In the event of a negative comparison result, the comparison means 43 send a signal for disabling the door to the latter's disabling means. Thus, this effectively prevents a cylinder containing a dangerous product from being introduced into the safety zone.

In another development (not represented) of this exemplary embodiment, the information memorized on the information medium furthermore comprises the type of cylinder in the guise of receptacle. A list of allowed types of cylinders is held in the memory means 41. This development operates in a similar manner to that of the embodiment described above. If the cylinder type is not among the list when presented to a reading device, an alarm is triggered.

Exemplary embodiment No. 3:

Figure 4 shows an embodiment of the installation 1 in which the task to be executed by the functional unit 5 relates to the delivery of gas cylinders and more particularly the allocation of a delivery to a customer for the invoicing of the latter.

For this purpose, the information recorded on the tag 29 comprises in particular the identification number of the cylinder and a product code designating the type and amount of product contained in the cylinder 3.

In order to be able to accompany a delivery person during his/her rounds, the functional unit 5 is portable and stowed on board a vehicle (not represented) for delivering gas cylinders. It comprises means 51 for registering information relating to said task to be executed. In greater detail, the registration means 51 comprise an apparatus 52 for determining the geographical position of the unit 5 for example of the type known by the name "differential GPS". Such an apparatus which is known per se outputs the geographical position of the unit 5 with an accuracy of around 1 m.

To be able to write the geographical position registered by the apparatus 52 to the electronic tag 29, the installation 1 furthermore comprises, linked to the means 51, a device 53 for remote writing of information to the electronic tag 29. The writing device comprises the means 31 for communication with the tag 29 and a unit 54 for preparing signals for

sending them via the means 31 to the tag 29. Advantageously, the reading device 13 and writing device 53 use the same communication means 31 and form a common unit 55 for exchanging information with the electronic tag 29.

Additionally, the exploitation means 17 comprise means 57 for memorizing a list of sites to be replenished and of their geographical positions as well as means 59 for comparing the geographical positions of the list with that output by the apparatus 52 during a delivery. Of course, the term geographical position of a site is understood more generally to mean the geographical zone in which the site lies. Moreover, the exploitation means 17 comprise means 61 for memorizing deliveries on a per client basis which are linked on the one hand to an output of the comparison means 59 and on the other hand to an output of the information read from the tag 29 of the unit 55.

To be able to be stowed on board, the functional unit 5 typically comprises a portable computer equipped with a system of the "differential GPS" type for determining its geographical position and with a unit 55 for exchanging information with the electronic tag 29 of the cylinder 3. The computer is loaded with software suitable for controlling the diverse elements of the installation 1.

During a round, the delivery vehicle stops at the various sites so as to deliver the cylinders as ordered to them. During such a delivery stop, the delivery person approaches the tag 29 for each cylinder to be delivered, with the communication means 31. The unit 55 then reads the identification number as well as the product code which are recorded on the tag 29 so as to transmit them to the exploitation means 17.

Moreover, the apparatus 52 determines the geographical position of the functional unit 5 and hence that of the site on which it is located. The unit 5 outputs this position on the one hand to the information exchange unit 55 so that the latter sends

it to the tag 29 for the recording of this position in the memory means 39, and on the other hand to the comparison means 59. The latter compare the position registered with those of the list of the memory means 57 so as to associate the delivery of the cylinder with the site whose position coincides with that registered by the apparatus 52. The site, the identification number of the cylinder and the product code are then recorded in the means 61 and can, on returning from the delivery round, be exploited in respect of the invoicing of customers.

Thus, the invoicing of customers is aided and the supplier acquires a better awareness of the geographical distribution of his inventory of cylinders.

By virtue of the information written to the electronic tag 29, a check is also made as to whether for example, within one and the same enterprise, a cylinder has been transferred from one site to another, thus making it possible to refine the sitewise invoicing, in particular as regards the cylinder rental fee.

Exemplary embodiment No. 4:

Figure 5 shows an installation for monitoring containers in this instance gas cylinders, comprising a storage zone or a facility 100 for distributing a stock of cylinders.

This facility 100 comprises a space 103 for storing cylinders, situated inside closed premises 105. Inside the storage space 103 is disposed a stock of various cylinders 107, 109 and 111. Each cylinder is received in a location 113 provided for this purpose. These locations 113 are separated from one another by horizontal bars 115 fixed against a wall 117 of the premises 105.

Among the gas cylinders may be distinguished full cylinders 107 and 109 of different types, such as acetylene cylinders and oxygen cylinders, as well as empty cylinders 111. The full cylinders 107 and 109 are

intended to be distributed to users, and the empty cylinders 111 are to be collected and/or exchanged by the supplier of gas cylinders for full cylinders. All the cylinders 107, 109 and 111 are equipped with an electronic tag 29.

To access the storage space 103, the premises 105 comprise an access 118 which can be closed with the aid of an entrance door 119 to the premises 105 so as to lock the cylinders 107, 109 and 111 inside the storage space 103. For this purpose, the door 119 comprises an automatic closure 121 such as those sold under the "Groom" brand name, and has an automatic locking device 123.

The exploitation means 17 of the functional unit 5, that is to say of the facility 100, are made in the form of a central unit 125 disposed outside the premises 105. This unit 125 is responsible for controlling access to the storage space 103, managing the stock of cylinders, and, if need be, triggering a replenishment order. For this purpose, it comprises various means which will be described in detail with reference to Figure 6 and some of which may be implemented by a computer or by an automatic controller loaded with a program to be executed.

With reference to Figure 5, it should again be noted that the unit 125 is linked to the means of control of the automatic locking device 123. Additionally, it comprises transmission means 127 for carrying out a dialogue with a gas cylinder replenishment center 129.

The transmission means 127 and the corresponding reception means of the replenishment center 129 may be of any type, in particular means of transmission over the airwaves.

Moreover, the facility 100 is equipped with a device 13 for reading information, only two read/write heads 130, 131 of which are represented. The heads 130, 131 are identical to the communication means 31 and are disposed one behind the other in the direction of

passage of the cylinders through the access 118 which is indicated by the double arrow 132. Preferably, these heads 130 and 131 are incorporated either into the opposite upright of the door 119 from the one carrying the door leaf 119, or into a separate gantry provided for this purpose.

The schematic diagram of the structure of the installation 1 of Figure 5 is represented in Figure 6.

The installation 1 comprises means 140 for authorizing a user to remove at least one cylinder disposed in the storage space 103. For this purpose, they comprise user identification means 142 such as for example a badge reader, a "digicode" or any other automatic identification means. There is provision to install these identification means 142 in the central unit 125.

In order to preclude access to the cylinders 107, 109 and 111 by unauthorized personnel, the authorization means comprise on the one hand disabling means 144, namely the door 119 and the device 123 for locking the door according to the example of Figure 5. These disabling means 144 are switchable between a position of disabling the cylinders 107, 109 and 111 disposed in said storage space 103 (door locked), and a distribution position (door 119 open) in which at least one of the cylinders 107 and 109 can be removed by an authorized user. On the other hand, they comprise means of control 146 of said disabling means 144. These control means 146, situated in the central unit 125, are connected to the identification means 142 so that access to the cylinders is granted to authorized users only. As a safety measure, the control means 146 comprise time-out means 147 for automatically switching disabling means 144 to the disabling position after a certain delay.

To ensure that a sufficient number of full cylinders is always disposed in the storage space 103, the central unit 125 comprises means 148 for evaluating the stock of cylinders. These stock evaluation means

148 comprise stock status memory means 150 loaded with the aid of means 152 for entering an initial stock status. The memory means 150 comprise three memory locations 150A, 150B and 150C respectively associated with the cylinders 107, 109 and 111. The means 152 are connected to the identification means 142. From the latter they receive an authorization signal so that only the supplier and a person responsible for the installation can update the status of the stock in the memory means 150. Moreover, the stock evaluation means 148 comprise means 154 for registering a removal or a placement of a cylinder so as to detect whether a user is removing or returning a gas cylinder. These means 154 are linked to the reading device 13. The means 154 comprise, linked to the reading device 13, means 156 for deducing the direction of movement of the cylinders in the access 118 so as to detect, from temporal analysis of the signals output by the heads 130, 131 of the device 13, whether a user is removing or returning a gas cylinder.

The evaluation means 148 furthermore comprise calculation means 158 to which are connected the means 150 for memorizing the status of the stock as well as the means 154 for registering a removal or a placement of a cylinder and the reading device 13.

On the basis of the status of the stock received by the memory means 150 as well as of the information output by the device 13 during the passage of a cylinder and on the basis of the information regarding a removal or a placement of a cylinder registered by the means 154, the calculation means 158 establish a new status of the stock.

Moreover, the evaluation means 148 comprise means 160 for memorizing identification codes of removed or returned gas cylinders, associated with the identity of a user. For this purpose, these means 160 are linked on the one hand to the identification means 142 and on the other hand to the calculation means 158 which output said identification code to them, this

code comprising in particular the type and nominal quantity of gas contained for the cylinder.

The exploitation means 17, that is to say the central unit 125, furthermore comprise means 162 for memorizing at least one minimum threshold of full cylinders required to be present in the storage space 103. Preferably, the memory means 162 comprise for each type of cylinder two memory locations, a first for memorizing a safety threshold serving for the triggering of a normal replenishment order, and a second for memorizing an emergency threshold serving for the triggering of an emergency replenishment order. Of course, the safety threshold is greater than the emergency threshold. In the example of Figures 5 and 6, the memory means 162 comprise four memory locations, two 164a, 164b for acetylene cylinders and two 166a, 166b for oxygen cylinders. The memory means 162 are linked to means of entering threshold values 168 so that these thresholds can be adapted to the needs of the users.

The installation 1 is equipped with means 170 for comparing the stock with the thresholds. For this purpose, an output of the calculation means 158 and an output of the memory means 162 are linked to corresponding inputs of the comparison means 170.

The stock comparison means 170 are connected to means 172 for triggering a replenishment order. The output of the triggering means 172 is linked to an input of the means 127 for transmitting a replenishment order to the center 129.

Another input of the transmission means 127 is linked to an output of the stock status memory means 150 so as to be able to transmit at any moment the current status of the stock of cylinders disposed in the storage space 103 to the replenishment center 129.

As may be seen in Figure 6, the central unit 125, delimited by chain-dotted lines, comprises the means 142, 146, 147, 148, 162, 168, 170 and 172.

The installation 1 of Figures 5 and 6 operates as follows.

An authorized user who wishes to return an empty cylinder and remove a full cylinder, for example of oxygen, identifies himself to the identification means 142.

After having recognized the user, the identification means 142 send an authorization signal to the means 146 for controlling the disabling means 144. The control means 146 then send an unlocking signal to the disabling means 144. Referring to Figure 5, this signifies that the automatic locking device 123 is deactivated, and the user can open the door 119 so as to place the empty cylinder in the storage space 103 and also for example to remove a full cylinder of oxygen 109.

During each passage of a cylinder, the device 13 reads from the electronic tag 29 of the cylinder the identification number of the cylinder together with the type and amount of gas contained in it and from the signals measured by the heads 130, 131 the means 156 deduce the direction of movement of the cylinder, and hence whether the latter is being removed or returned. All this information is transmitted to the calculation means 158.

The calculation means 158 increment by one unit the number of empty cylinders memorized in the means 150A for memorizing the status of the stock in the case where the means 154 detect that a cylinder has been returned, and decrement by one unit for example the number of oxygen cylinders which is memorized in the means 150B in the case where the means 154 detect the removal of a cylinder 109.

Preferably, after the user has finished his operations and the locking device 123 has been reactivated by the control means 146, the new status of the stock is transmitted by the means 158 to the means 170 for comparing the stock with the thresholds memorized in the means 162 for memorizing the

thresholds. The comparison means 170 compare, on a type of cylinder basis, the new status of the stock with the corresponding thresholds. If the number of full cylinders of all the types of cylinders is greater than the corresponding thresholds predefined by the user, the means 170 do not transmit any control signal. If on the other hand the number of full cylinders of at least one type is less than the predefined corresponding threshold, then a replenishment order, normal or emergency, is triggered as a function of the threshold crossed, by a control signal sent by the comparison means 170 to the means 172 for triggering an order. Next, the triggering means 172 send a signal to the transmission means 127 so that the latter transmit the order to the replenishment center 129.

In the case of replenishment of the installation by a supplier, the latter is then identified as supplier by the identification means 142. These identification means 142 then activate the means 152 of entering an initial status of the stock so that the supplier can optionally update the status of the stock in the memory means 150 in the case where a fraudulent action has impeded management of the stock. This function of reupdating the status of the stock can also be allocated to a person responsible for the facility 100.

In a development of the facility represented in Figure 5 intended in particular for an installation for the sale of gas cylinders, there is provision to equip each location 113 with a reading device 13 instead of providing a single reading device 13 for the entire facility, the read heads of which are disposed in the access to the storage space. Each device 13 is linked to the means 148 for evaluating the stock of cylinders, and more particularly to the calculation means 158 and to the means 154 for registering a removal or a placement of a cylinder. Each device 13 then additionally fulfills the function of a detector of the

presence of a cylinder in the location associated therewith.

The manner of operation of this development is similar to that described with reference to Figures 5 and 6 but instead of detecting the identification codes of the cylinders which enter and leave the storage space and their directions of movement in the access, the reading devices 13 of each location register only the identification codes of the gas cylinders which are placed correctly in the locations 113 and output a signal indicating the presence or absence of a cylinder to the means 154 for registering a removal or a placement of a cylinder. Through the fact that a cylinder is only recorded as being returned when a device is constrained to correctly replace the gas cylinder returned in a location 113 provided for this purpose. A user who does not correctly return his gas cylinder is penalized since, because the gas cylinder is not recorded as being returned, it continues to be charged to him in respect of the payment of the rental fee.

Figure 7 shows a variant of the facility of Figure 5 allowing the management of such a facility by means of electronic tags 29 and of information reading devices even in respect of cylinders which are not previously equipped with an electronic tag.

For this purpose, the installation 1 furthermore comprises an access bay 200 to the facility 100 for distributing a stock of gas cylinders, the rear wall of which is formed by the access part of the premises 105 in which the door 119 is installed.

The bay 200 delimits an enclosure 203 inside which is disposed a station 205 for attaching information media, in particular electronic tags, to gas cylinders and for detaching them.

To access the enclosure 203, the bay 200 comprises an access 207 which can be closed with the aid of an entrance door 209, represented in the closed state. The door 209 is identical to the door 119

and also has an automatic locking device 213 identical to the device 123.

The central unit 125 is mounted beside the door 209 for entering the bay 200 and linked not only to the means of control of the device 123, but also to the means of control of the device 213.

The station 205 comprises an automatic apparatus 215 for distributing and collecting electronic tags 29 and, tied to the apparatus 215, a special attachment and detachment tool 217. This tool 217 is adapted so that it is indispensable for attaching an electronic tag 29 to a gas cylinder, and in particular for removing such a tag so as to prevent fraudulent detachment.

Represented in Figure 8 is the schematic diagram of the structure of the installation 1 of Figure 7. This diagram is distinguished from that of Figure 6 by the fact that the authorization means 140 furthermore comprise means 219 for disabling the bay, namely the entrance door 209 to the bay 200 and the locking device 213. These disabling means 219 are switchable between a disabling position (door 209 locked) and a position of access to the enclosure 203 (door 209 open). The disabling means 219 are linked to the means 146 and controlled by them in such a way that the device 123 and the device 213 are never simultaneously in an inactive position. Moreover, the apparatus 215 is also linked to the means 146 so as to send to these means 146, signals corresponding to the distribution or collection of an electronic tag 29 or to receive a signal corresponding to the state of activation of the locking devices 123 and 213.

During operation, an authorized user identifies himself to the identification means 142. After having recognized the user, the identification means 142 send an authorization signal to the means 146 of control of the disabling means 144 and 219. The control means 146 then send an unlocking signal to the disabling means 219. Referring to Figure 7, this signifies that the

automatic locking device 213 is deactivated, and the user can open the door 209 so as to enter the enclosure 203 with his empty cylinder. After a predefined delay, the device 213 is reactivated by the control means 146 and the user is shut inside the enclosure 203. Of course, during this time the locking device 123 remains activated so that access to the distribution facility 100 is still precluded.

The control means 146 send a signal to the apparatus 215 so as to signal to the latter that the door 209 is again closed. On receiving this signal, the apparatus 215 distributes an electronic tag 29. The user can then attach the electronic tag 29 to the empty cylinder by means of the tool 217. The information recorded on the distributed electronic tags comprises in particular the empty state of the cylinder so as subsequently to allow the means 148 to correctly evaluate the stock of cylinders in the space 103.

Subsequent to the distributing of the tag, the apparatus 215 sends an electronic tag 29 distributing signal to the control means 146. The means 146 then send an unlocking signal to the disabling means 144. The user can then access the storage space 103 and hand back his empty cylinder and take a full cylinder. Of course, all the cylinders 107, 109, 111 disposed in the storage space 103 are equipped with an electronic tag 29.

The subsequent operation of the installation of Figures 7 and 8 in particular as regards the means 148 for evaluating the stock is similar to that of the installation of Figures 5 and 6.

After leaving the storage space 103, the user recloses the door 119 and the control means 146 reactivate disabling means 144. The disabling means 146 are contrived in such a way that the door 209 of the bay 200 opens only on condition that the user hands back the electronic tag 29 attached to the full cylinder which he has taken, to the apparatus 215. The user then detaches the electronic tag 29 with the aid

of the tool 217 and hands the tag back to the apparatus 215. The apparatus 215 then sends a tag collection signal to the disabling means 146 which deactivate the disabling means 219 so that the user can open the door 209 and leave with his full cylinder. After a certain delay, means 146 reactivate the disabling means 209.

Additionally, there is provision to equip the facility with means of reception and of checking of operation, which are intended to receive control signals from the replenishment center 129 with a view to remote checking of the state of operation of the facility 100.

Exemplary embodiment No. 5:

Figure 9 shows an installation 1 in which the functional unit 5 is a system for locating gas cylinders 3 on an industrial site 300.

This system comprises, distributed throughout the site 300, various zones 302, 304, 306 and 308 of use or storage of gas cylinders. There is for example provision for one of the zones 302, 304, 306, 308 to be a facility for distributing a stock of cylinders as described hereinabove.

Each zone 302, 304, 306, 308 comprises at least one access 310. As represented on the upper central access 310, a unit 55 for reading and for exchanging information with the electronic tags 29 attached to the cylinders 3 is associated with each access 310. These units 55 are linked by way of a computer bus 312 to the exploitation means 17. These exploitation means 17 comprise means 314 for determining the positions of the cylinders on the site. For this purpose, they comprise means 316 for memorizing cylinder identification codes associated with a code of the zone 302, 304, 306 or 308 into which each cylinder 3 has been introduced.

Additionally, the means 314 for determining the positions of the cylinders furthermore comprise means 317 for memorizing the successive movements of the cylinders between the various zones 302, 304, 306 and 308 of storage or use. Preferably, the means

317 memorize not only the movement of a cylinder, but also the identity of the user having performed this movement.

For this purpose, the access 310 of each zone 302, 304, 306, 308 comprises authorization means 318 identical to the authorization means 140 described with reference to Figures 5 and 6. That is to say these authorization means 318 comprise means 320 for disabling gas cylinders in the relevant zone, for example a door and a device for locking the door and on the other hand means 322 of control of the disabling means as well as means 324 for identifying a user so as to grant access to the various zones 302, 304, 306 and 308 to authorized users only.

The identification means 324 are also linked to the buses 312 so as to transmit the identity of the user to the memory means 317.

When a user wishes for example to move a cylinder 3 from the zone 304 to the zone 306, he presents himself at the access 310 of the zone 304 so as to identify himself and obtain access to this zone.

The authorization means 318 grant him access to the zone 304 and the user can remove a cylinder 3 from this zone 304. When he takes out the cylinder 3, the unit 55 transmits the identification code of the cylinder 3 to the memory means 316 together with the fact that the cylinder has been removed from the zone 304. The identification means 324 transmit the identity of the user to the means 316.

Thereafter, the user presents himself at one of the accesses 310 of the zone 306. He identifies himself to the identification means 324 so that the authorization means 318 grant him access to this zone. When he introduces the cylinder 3 into the zone 306, the identification means 324 as well as the unit 55 respectively transmit to the means 316 the identity of the user as well as the identification code of the cylinder, an identification code of the zone into which the cylinder has been introduced. The means 316 then

memorize the identification code of the cylinder associated with the identification code of the zone, thus making it possible, through simple interrogation of the memory means 316, to ascertain the whereabouts of each gas cylinder disposed on the site 300. The means 317 memorizing the movement of the cylinder as well as the identity of the user having performed this movement. For this purpose, the means 317 memorize the identification codes of the zones from which the cylinder has been respectively removed and returned, the identification code of the cylinder and the identity of the user.

When crossing one of the accesses 310, the zone into which the cylinder has been introduced or from which it has been removed, is also memorized on the electronic tag 29 so as to be able subsequently to discern fraudulent operations with the gas cylinders.

On the basis of the means 317, statistics regarding consumption and the rate of rotation of the cylinders per zone as well as a history of movements per cylinder can be compiled and made available to the customer.

Figure 10 presents a variant of the installation of Figure 9 in which the functional unit 5 comprises a portable terminal 350.

The portable terminal 350 comprises a unit 55 for exchanging information, an apparatus 52 for determining the geographical position of the terminal 350 for example of the type known as "differential GPS", means 352 for identifying a user, a clock 354 and means 356 of communication, especially wireless, with the means 314 for determining the positions of the cylinders so as to transmit to the latter means, after a movement of a cylinder, the identity of the user having performed this movement, the identification code of the moved cylinder which is read from the electronic tag 29 as well as the geographical position output by the apparatus 52 for determining this geographical

position and, moreover, the date and time output by the clock 354.

Preferably, the portable terminal 350 is formed by a portable computer equipped with a system of the GPS type for determining its geographical position and with a unit 55 for exchanging information with the electronic tags 29 of a cylinder 3. Additionally, the computer moreover comprises the means of communication 356 with complementary means 358 of communication of the means 314 for determining the positions of the cylinders on the site 300, for example over the airwaves.

A user who wishes to move a gas cylinder 3 furnishes himself beforehand with a portable terminal 350 and moves the former toward its point of destination. When the cylinder 3 is deposited at the point of destination, the information memorized on the tag 29 is read by means of the unit 55 and the geographical position and the identification of the user are written to the tag 29 and communicated to the means 314. Instead of an identification code of a zone, the means 314 interpret the geographical position of the cylinders directly and record it, together with the identification code of the cylinder and the identity of the user in the means 316. Moreover, this information is also transmitted to the means 317 for the memorization of the successive movements of cylinders performed by each user.

Exemplary embodiment No. 6

Figure 11 shows a particular installation 1 in which the functional unit 5 is a station 400 for filling gas cylinders.

This station comprises a filling pipeline 402 coupled to a gas cylinder 3 so as to fill the latter with a product, especially acetylene. Moreover, regulating means 404 are disposed in the pipeline 402 so as to regulate the flow rate of acetylene therein.

The station 400 furthermore comprises an automatic balance 406 on which the cylinder 3 is

placed. The exploitation means 17 comprise calculation means 408 linked on the one hand to the unit 55 for exchanging information with the tag 29 and to the automatic balance 406, and on the other hand to means of control 410 of the regulating means 404.

The manner of operation of the station 400 will be described in the case where the cylinder 3 is a cylinder of acetylene dissolved in a solvent. When bottling acetylene in gas cylinders, it is dissolved in a solvent contained in the cylinder 3. For filling the cylinder with acetylene, the cylinder 3 is placed on the balance 406 which transmits the total weight of the cylinder to the calculation means 408. Moreover, the unit 55 reads the information recorded on the tag 29, namely the tare and the nominal quantity of the cylinder 3. On the basis of this information, the calculation means 408 deduce the amount of solvent in the cylinder 3 and the amount of acetylene which can be dissolved in the solvent contained in the cylinder 3. The calculated amount of acetylene is transmitted to the control means 410 adjusting the regulating means 404 in such a way that this amount is introduced into the cylinder 3.

Figure 12 shows a variant of a station 400 for filling containers. This station 400 comprises a manifold 420 for filling gas cylinders, formed by a main pipeline 422 and three branchoffs 424 linked via one end to the main pipeline 422 and via the other end to gas cylinders 3 with a view to the filling of the latter. The cylinder 3, situated furthest to the left in the figure, serves as "control cylinder", the filling of which is monitored by means of the balance 406. For each branchoff 424, the station 400 comprises a unit 55 for exchanging information with the electronic tags 29 attached to the cylinders 3. These units 55 are all linked to the exploitation means 17.

The exploitation means 17 comprise a clock 426 and means 428 for memorizing the identification code of each cylinder 3 filled at the manifold 420.

The filling of the cylinders is performed in a similar manner to that described in Figure 11, the calculation means 408 taking into account that three rather than just one cylinder 3 are to be filled. When filling the cylinders 3 at the manifold 420, the exploitation means 17 transmit to each unit 55 a batch number, the type of product introduced into the cylinders and also the date and time of filling so that this information is memorized on the electronic tag 29 of each cylinder 3. This same information is also recorded in the means 428.

Thus, the traceability of the batches of gas cylinders filled at the same time is ensured. Moreover, in the event of the failure of a manifold, the recalling of cylinders belonging to a batch is made easier by virtue of the information stored in the memory means 428 and on the electronic tags.

In a development of the station 400 of Figure 12, the position of the electronic tag in the manifold 420 is also written to the former. The degree of fill of cylinders picked at random from a batch of full cylinders is subsequently checked by weighing. If certain filling defects are related to the position of the cylinder on the manifold, this correlation is apparent by virtue of the recording of this position at the moment of filling.